

## **G. Fred Lee & Associates**

---

27298 E. El Macero Dr.  
El Macero, California 95618-1005  
Tel. (530) 753-9630 • Fax (530) 753-9956  
e-mail [gfredlee@aol.com](mailto:gfredlee@aol.com)

web site: <http://members.aol.com/gfredlee/gfl.htm>

Please note the new area code for telephone and fax has been changed to 530

via e-mail

March 27, 1998

Judy Heath  
CALFED Bay-Delta Program  
Water Quality Technical Group  
1416 Ninth Street; Ste 1155  
Sacramento, CA 95814

Dear Judy:

A couple of months ago you asked me to review a draft statement developed by Gail Louis of the US EPA Region 9 on a mercury control strategy for the Delta. I wish to follow up my comments on that draft statement with some additional comments. These additional comments arise from my attending a Cache Creek watershed stakeholders meeting on March 9, 1998 where the program was devoted to Cache Creek mercury issues. This situation provided an opportunity to hear various "experts" and the public discuss their views on these issues.

### **Significance of Cache Creek as a Source of Mercury for the Delta**

Based on the work of Chris Foe and others, there is no question that Cache Creek represents one of the most important sources of total mercury for the Yolo Bypass and the Delta, including the northern part of San Francisco Bay. The total annual loads that are carried by high winter stormwater runoff flows of total mercury derived from Cache Creek appear to be about the same as that derived from the rest of the Sacramento River watershed. With respect to understanding the sources of mercury for Cache Creek, the work of several groups is beginning to narrow in on some of the more important sources of total mercury. Within a few years and possibly with additional support, it should be possible to better understand the specific sources of mercury within the Cache Creek watershed that significantly contribute to the total mercury that is carried into the Delta each year. There is general agreement that this is a high-priority area for activity. From the information available, it appears that while there is general mercury contamination throughout much of the upper Cache Creek watershed in the former mining areas, only a few of the potential sources appear to be controlling the high concentrations of mercury that are associated with high stormwater flows each winter.

### **Water Quality Impacts of Mercury**

Fish and other aquatic life throughout most of the Cache Creek watershed contain excessive mercury based on US EPA Region 9 guidance of one meal per week. In some areas,

the edible fish contain excessive mercury based on US EPA and FDA guidance/action levels for one meal per month. Some fish in San Francisco Bay have been found to exceed both the one meal per week and many fish exceed the one meal per month mercury guidance value. It has recently been found that the Sacramento River system from Shasta through past Sacramento have white catfish with mercury above the one meal per week guidance value. Trout taken from these waters are not bioaccumulating excessive mercury based on the one meal per week value. At this time, the current mercury concentrations in Delta fish are unknown but are suspected to be above guideline values. I understand that a program that is funded by CALFED that is being conducted by the DeltaKeeper and the Regional Board is addressing this issue

One of the issues that needs to be resolved in the near future is the actual consumption rate of fish from various areas of Cache Creek as well as the Delta. Bill Jennings, of the DeltaKeeper, has indicated that there are some Asian heritage populations that are consuming fish from the Delta at more than one meal per week. If this is the case, then this could significantly decrease the allowed fish tissue mercury levels from the 0.14 mg/Kg value currently recommended by the US EPA Region 9 for the one meal per week consumption rate.

It is also possible, although there is no direct evidence for this at this time, that higher trophic level organisms, such as mammals and fish-eating birds, i.e. eagles, may be adversely impacted by the elevated mercury content of fish and insects in Cache Creek.

### **Bioavailable Mercury**

There is general agreement among the "experts" that the issue I have raised several times with the CALFED Water Quality Technical Group management of focusing on bioavailable mercury in the mercury control program for the Delta is the approach that must be followed if CALFED funds are to be used wisely. It does not appear that the approach that the CALFED Water Quality Technical Group has adopted of setting the US EPA water quality criteria/state standards as the target value for mercury control is an appropriate approach to be followed for mercury and, as will be demonstrated eventually, for many other constituents.

With respect to mercury, there is considerable evidence that mercury in various forms has significantly different bioavailability. For example, because of its very low solubility, the mercury ore cinnabar which is a mercury sulfide mineral, is considered to be non-bioavailable or at least its bioavailability is low. Chris Foe has recently informed me that he is aware of a study that showed that mercury in cinnebar is bioavailable. The issue that must be addressed however is whether the cinnebar which is likely to be the primary mineral in the high Cache Creek winterflow mercury is converted to methylmercury at a sufficient rate within the Delta and northern San Francisco Bay to significantly contribute to the excessive mercury concentration in Delta and Bay fish. It is possible that laboratory studies on cinnebar could show that while it is bioavailable, the rate of conversion to methylmercury is sufficiently slow under ambient water conditions to be of minor importance in contributing to the excessive mercury bioaccumulation problems.

At the March 9<sup>th</sup> meeting, I found that some of the statements made about bioavailable mercury are not based on a proper assessment of this situation. Through discussions with some of those making these statements, I learned that they are basing their bioavailable mercury statements with respect to various mercury species on the ingestion by mammals. It has been known for well over 30 years that bioavailability through stomach-intestinal track uptake in mammals can be significantly different than bioavailability in the environment for such things as methylation to convert to methylmercury which, in turn, bioaccumulates in fish tissue. It is also clear that mercury that accumulates in fish and other aquatic life is not necessarily only methylmercury. While it is often the dominant form, there is evidence that other forms of mercury are becoming associated with organisms.

One of the key areas of concern is the potential for cinnabar ores which occur in large amounts near former mercury smelting areas as waste piles/tailings to contribute mercury in bioavailable forms. I have discussed this issue in my past writings where I have mentioned the need to specifically address this issue, not only with respect to what happens in Cache Creek, but from a CALFED perspective, what happens in the Delta and in the upper reaches of San Francisco Bay. Carefully designed and implemented studies need to be carried out in the near future to determine which of the high winter flow forms of mercury that are carried by Cache Creek are, in fact, bioavailable in the various environments that exist in the Delta and Upper Bay.

While there are some who claim they can use certain chemical procedures to make estimates of bioavailable forms, great caution must be exercised in accepting these claims as reliable. Often, the mercury that accumulates in various areas is a mixture of forms and while the dominant form might be a non-bioavailable form, there may be enough other forms which would be considered minor based on chemical testing procedures, to lead to excessive bioaccumulation. It is my recommendation that a combination of specific chemical measurements including methylmercury as well as some of the techniques developed by Darell Slotton of actually measuring mercury that accumulates in benthic organism be used to assess bioavailability.

### **Shallow Water Habitat**

There is considerable concern among the experts about CALFED and others developing shallow water habitat where the area could be exposed to Cache Creek high mercury flows. Shallow water habitats(wetlands) are well-known to promote methylmercury formation. By actively pursuing shallow water habitat development, CALFED could be creating massive problems of excessive bioaccumulation in fish and other aquatic life that develop in these areas. I appreciate that CALFED support of shallow water habitat mercury bioaccumulation work is being conducted. I recommend that this work be critically reviewed by an independent panel to be sure that it covers all of the areas that need to be covered to protect CALFED's/the public's interests.

In addition to reviewing the issue of shallow water habitat developing methylmercury that bioaccumulates to excessive levels within fish and other aquatic life, by a critical review of the

current on-going studies on mercury, it would be possible to identify significant information gaps that need to be filled in the mercury information base that is needed to formulate a technically valid, cost-effective control program to begin to manage the mercury problem in Cache Creek, the Delta and upper San Francisco Bay. The Cache Creek mercury meeting has provided additional support for many of the issues that I raised previously on the approach that CALFED needs to consider to begin to formulate a mercury management program for Delta fish. A particular importance is the need to develop a CALFED mercury technical leader who would be assisted by an advisory panel that would advise CALFED management on how best to proceed to develop and then implement a technically valid and cost-effective mercury control strategy for the Delta.

I have previously mentioned that the US EPA has developed a set of documents devoted to a national review of the environmental mercury problem. I have recently received notice that the agency released "Mercury Study Report to Congress. Volume 7. Characterization of Human Health and Wildlife Risks from Mercury Exposure in the United States. 166P" (NTIS order number: PB98-124795LEU). This volume is primarily devoted to characterization of the risk for mercury emitted to the environment from various anthropogenic sources. The volume describes human and wildlife effects of mercury exposure including analysis of uncertainty in quantitative risk estimates. The agency has also released "Mercury Study Report to Congress. Volume 8. An Evaluation of Mercury Control Technologies and Costs." (NTIS order number: PB98-124803LEU).

The US EPA has also recently released the Second Edition of "Guidance for Assessing Chemical Contaminant Data For Use in Fish Advisories Volume II: Risk Assessment and Fish Consumption Limits (EPA 823-B-97-009)". This volume is available from the US EPA, National Center For Environmental Publications and Information, 11029 Kenwood Rd., Cincinnati, Ohio, 45242, or calling 513-489-8190.

If there are questions about these comments, please contact me.

Sincerely yours,

*Fred*

G. Fred Lee, PhD, DEE

Copy to: R. Woodard  
L. Snow  
L. Winternitz  
S. Yee  
C. Foe  
G. Louis

GFL:oh